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Sexual dysfunction in reproductive-aged women post-SARS-Cov-2 infection: A study in Ho Chi Minh City, Vietnam

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ABSTRACT

Objective(s): To determine the sexual dysfunction rate and related factors in women of reproductive age who had been infected with SARS-CoV-2 in Phu Nhuan District, Ho Chi Minh City, Vietnam. **Methods:** A cross-sectional study was conducted between 01/11/2022 and 30/03/2023 over 387 women aged 18 – 49 years who had been infected with SARS-CoV-2 at least one time, and were living in Phu Nhuan District, HCM City. Data collection was made by online interview with Google form based on FSFI questionnaire. **Results:** Overall sexual dysfunction rate in the women of study is 57.6%; the rates of specific sexual domains include reduced libido (92.2%); reduced arousal (82.7%); insufficient lubrication (69.3%); anorgasmia (73.6%); lack of satisfaction (81.9%), and dyspareunia (63.6%). Women with sexual dysfunction were referred to the Sexual Counseling Unit of Tu Du Hospital for appropriate intervention. Poisson multivariate regression analysis shows that “age group 41-49” has a 1.37 times higher risk of overall sexual dysfunction than age group 18-30 (PR*: 1.37; 95%CI 1.06 – 1.76), and women with sexual dysfunction have “a shorter interval between SARS-CoV-2 infection and the survey point of time” than those without sexual dysfunction (p= 0.005). **Conclusion:** Overall, sexual dysfunction and specific sexual disorder rates remarkably increased in Phu Nhuan women of reproductive age who were infected with SARS-CoV-2. Therefore, there should be a post-Covid strategy to screen for early detection and prompt intervention to help influenced subjects.

Keywords: Female sexual dysfunction, SARS-CoV-2, Covid-19, Vietnam.

1. INTRODUCTION

A new virus named SARS-CoV-2, which caused acute respiratory syndrome in 2019, was first reported in Wuhan (China) and then spread worldwide (Shi et al., 2020). Rapid transmission resulted in several severe measures to control the pandemic, which have negatively impacted the mental and sexual health of individuals, including infected women (Pennanenlire et al., 2021). There is a lot of data on its impact on the respiratory, neural, and digestive systems; however, its influence on female sexual function has been little studied. Before the COVID-19 pandemic, female sexual dysfunction (FSD) was frequent and affected the quality of life of many women. The FSD rates in European countries and the United States ranged from 24.4% to 82.2% (Lara et al., 2008; West et al., 2004). In Southeast Asian countries, including Vietnam, female sexuality is a new area, even for reproductive healthcare physicians (Singh et al., 2009; Sidi et al., 2007).

Ho Chi Minh City (HCMC) is one of the largest economic, cultural, and educational cities in Vietnam. In 2013, the sexual dysfunction rate among women of reproductive age in the city was 34.2%. During the COVID-19 pandemic, this location experienced the worst disease levels, with more than 600,000 infected patients. The Phu Nhuan District was a disease hotspot, with more than 14,000 patients infected with SARS-CoV-2. To assess the impact of the pandemic on female sexual function, we conducted a surveyed among women of reproductive age who had been infected with SARS-CoV-2 in Phu Nhuan District to determine the sexual dysfunction rate and related factors.

2. MATERIAL AND METHODS

Protocol registration

A cross-sectional study was conducted from 1/11/2022 to 30/3/2023 with 387 women aged 18–49 years who had been infected with SARS-CoV-2 at least once and were living in Phu Nhuan District. The study was approved by the Ethics Council for Bio-Medical Research of the HCM City University of Medicine and Pharmacy (document number 709/HĐĐĐ-ĐHYD) on 10/10/2022. Data collection was approved on 21/10/2022 by the Phu Nhuan District Health Center. Written informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Eligibility criteria

Women who were living with their husbands or sexual partners, had engaged in minimal heterosexual activities within a month, were able to understand Vietnamese, and agreed to answer the questionnaire were included in the study. Women who had moved out of the district, were pregnant, or had linguistic problems, such as dumbness, deafness, and mental disorders, were excluded.

Sample Size

The study employed a formula to estimate the rate of occurrence with absolute precision: $d = 0.05$, and type I error = 0.05. Since previous studies found various FSD rates in communal women (20–80%) Singh et al., (2009), Sidi et al., (2007), we selected $p = 0.5$ to ensure the most robust sample capacity for the principal objective by the largest sample size. The estimated sample size in the study was 386 plus an expected loss of 20% due to failure of connection, refusal to participate, or exclusion criteria. Therefore, the sample size of this study included 463 women.

Sampling Procedure

The population sample size was determined by using a probability proportional to size (PPS) sampling method. Data were collected through online interviews using Google Forms based on the Female Sexual Function Index (FSFI) questionnaire, which was locally customized and translated into Vietnamese.⁷

Step 1: From the list of residents infected with SARS-CoV-2 in Phu Nhuan District during the period of 1/5/2021–31/12/2022, we selected all 18-to-49-year-old females living with their husbands or partners. We excluded all cases who had died, moved away, and omitted contact details; 3541 women were sorted according to the time of infection for the sampling list. Step 2: The PPS technique was applied to the sample with an interval of $3541/386 = 9$ and a random number $R = 6$. The first woman selected held the 6th position, and the

nth person held the ordinal position of $6 + (n-1) \times 9$. Therefore, we obtained a formal sample of 393 women and 70 substitutes. The sampling technique helped select a sample representative of the reproductive-age female population infected with SARS-CoV-2 in the Phu Nhuan District (Figure 1).

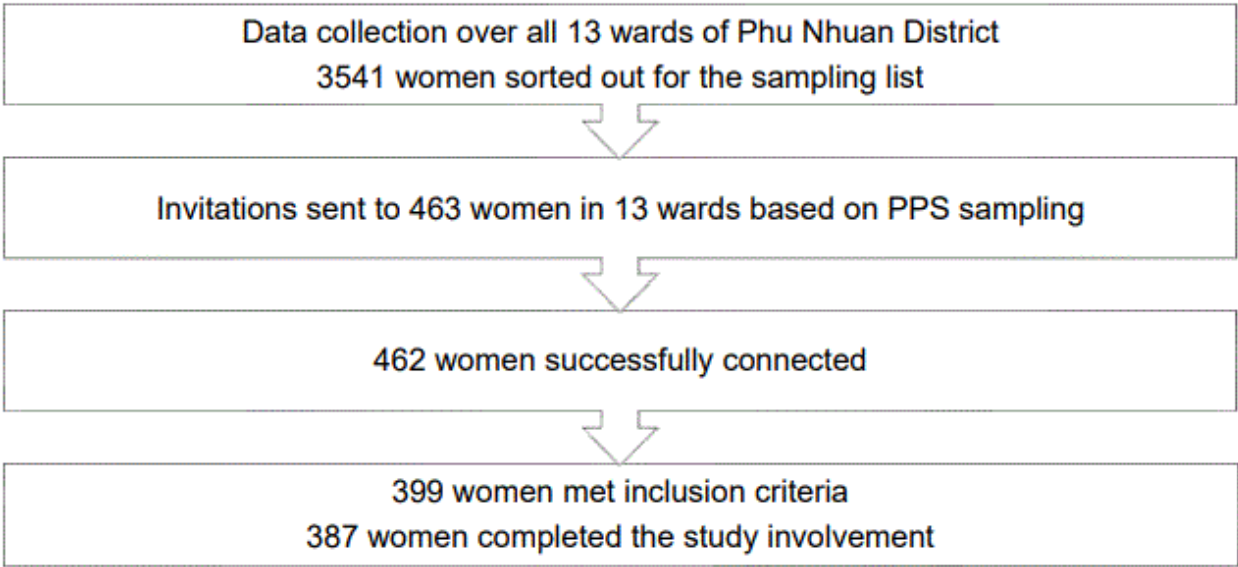


Figure 1 Flow chart: Summary of 387 subject admissions into study sample.

Measurements/ Instrument

The data collection tool was a Google form with 26 questions, including 2 questions on basic information, 3 questions on previous SARS-CoV-2 infections, 19 questions on the FSFI, and 2 questions on sexual comparison of pre- vs. post-SARS-CoV-2 infection. We used the Vietnamese version of the FSFI questionnaire, which was locally customized by. This version was tested for acceptability, applicability, value, and reliability. The FSFI (developed by Rosen et al., (2000)) has been used in many countries and is an effective analytical tool for assessing female sexual function assessment (Wiegel et al., 2005; Meyer-Bahlburg et al., 2007).

The questionnaire consisted of 19 questions assessing six sexual domains: Libido, arousal, vaginal lubrication, orgasm, satisfaction, and pain. Each question was scored within a range of 0–5. The score for each domain was calculated by summering all scores for the questions in that domain and then multiplying the total with a coefficient. The total FSFI scores of the six domains ranged from 2 to 36. If the total FSFI score was <26.55, the overall sexual dysfunction was positive. The scoring thresholds of each domain to determine sexual disorder were <4.28, <5.08, <5.45, <5.05, <5.04; and <5.51 for reduced libido, reduced arousal, insufficient vaginal lubrication, anorgasmia, lack of satisfaction, and dyspareunia, respectively.

1. Overall, sexual dysfunction was a binary variable. The sexual dysfunction status of women in the study was positive when the total FSFI score was <26.55. The exposure variables of interest were the number of SARS-CoV-2 infections and the post-SARS-CoV-2 infection period.
2. The number of SARS-CoV-2 infections was a quantitative variable. This is the total number of SARS-CoV-2 positives determined by RT-PCR or rapid antigen testing.
3. Hospitalization for SARS-CoV-2 treatment was a binary variable. This represents the number of hospitalizations required for treatment of the infection.
4. Post-SARS-CoV-2 infection period was a quantitative variable. The point in time when the subject answered the questionnaire was subtracted from the point in time of the last SARS-CoV-2 infection.
5. The age of study participants was a quantitative variable calculated by subtracting the participants’ year of birth from the year of the study.

6. Obstetric history was a nominal variable with four values for the subject of birth delivery modes.
7. Intercourse frequency of pre- vs. post-SARS-CoV-2 infection was a nominal variable with three values for changes in subjects' coital frequency after SARS-CoV-2 infection.
8. Sexual satisfaction pre- vs. post-SARS-CoV-2 infection was a nominal variable with three values (same as previously, less than, and more than previously).

Research Procedure

Step 1: Pilot study

Before the full-scale study, a small pilot study was conducted with ten women (from the sampling list, but not on the participation list for the full-scale study) in ward #9 of Phu Nhuan District. The purpose of this pilot study was to identify any difficulties in answering the questions on the Google form and to adjust the informatic technology to fit the local level. We contacted these women via phone, then Zalo connection, and sent the link explaining the pilot study and requesting their involvement. We also reminded them to answer the questions alone, that is, not in the presence of anyone else. The results demonstrated that the participants found the questionnaire easy to understand, and Google Forms presented no challenges. The average duration of the online interviews was 14 minutes. Data from these ten women were excluded from this study.

Step 2: Invitation to study

The staff at the communal health station made phone calls to women to set up appointments at their homes. The principal researcher and his collaborators came to the houses of the subjects who met sampling inclusion criteria and were selected on PSS from the list of SAR-COV-2 infected women in Phu Nhuan District. We explained to them the research objectives and methodology. If they agreed to join the study, they signed a consent form, received a link to Google form for fill-in at their idle time and submitted online. From 1/11/2022 to 30/3/2023, we gained access to 462/463 of the women invited to participate. Personal business was cited as a reason for refusal to participate by some women. After face-to-face meetings, 399 women met the inclusion criteria and signed a consent form.

Step 3: Data collection

The study team and the selected women were connected via the Zalo social network. The study team then sent the questionnaire in Google form to the participants and provided instructions on completing it when they had 15 minutes of free time and in the absence of anyone else. Simultaneously, each participant was assigned an identity code instead of personal names on the form while answering online interviews to maintain confidentiality. The form completion time was stated clearly, and if nobody submitted their forms near the due date when checking the system, we would call to remind them of form fill-in. Participants were able to leave the study at any time without negative consequences. After the participants had completed the questionnaire, the data were automatically stored on Google Drive.

Step 4: FSFI score calculation and counseling on intervention for women with sexual dysfunction

The online questionnaire was completed by 387 participants, that is, a 97% response rate. The study team scored the completed forms for each domain and calculated the total FSFI score. Those with overall FSD or sexual domain disorders were referred to the Sexual Counseling Unit of Tu Du Hospital for timely management.

Statistical Analysis

The data analysis was conducted using the Stata 14.0 statistical package. Qualitative variables were reported in terms of frequency and rate. Quantitative variables were reported as mean values and standard deviations. A Poisson multivariate regression model assessed the relationship between the FSD and related factors. A potential confounder would be included in the final multivariable Poisson model if the association between this variable and FSD in bivariate analysis had a P-value of 0.2 or smaller. Adjusted Prevalence Ratios (PR) and their 95% confidence intervals were reported.

3. RESULTS

The mean age of the sample was 36.5 ± 7.1 years. Most participants were in the 31–40 age group (46.2%). Of the 328 women (84.7%) who had given birth, the majority had experienced cesarean sections (171 cases, 44.1%). More than 76% of women had experienced one SARS-CoV-2 infection, 20.2% had experienced two, and the rest had experienced three or more. Approximately 10% of patients had been admitted to hospital. The mean interval from the last infection to the point of the survey was 11.8 ± 7.0 months (Table 1).

Table 1 Common characteristics of study sample

Description	Quantity (N= 387)	Rate (%)
Age	36.5 ± 7.1 [21–49]	-
Age groups		
18-30	94	24.3
31-40	179	46.2
41-49	114	29.5
Obstetric history		
No birth	59	15.3
Normal birth	157	40.6
Cesarean section	171	44.1
Number of SARS-CoV-2 infection		
1	297	76.7
2	78	20.2
≥ 3	12	3.1
Hospitalization		
Yes	38	9.8
No	349	90.2
Post-infection period (months)*	± 7.0 [1-22]	-

(*) The point in time when the subject answered the questionnaire was subtracted from the point in time of the last SARS-CoV-2 infection.

Table 2 shows that the overall FSD rate of the sample is 57.6% (Figure 2). The sexual disorder of “reduced libido” scored highest (92.2%), and “dyspareunia” scored lowest (63.6%).

Table 2 Rates of sexual disorder

Sexual dysfunction domains	Cases (n= 387)	Rate (%)	95%CI
Overall sexual dysfunction	223	57.6	52.5-62.6
Reduced libido	357	92.2	89.1-94.7
Reduced arousal	320	82.7	78.5-86.3
Insufficient lubrication	268	69.3	64.4-73.8
Anorgasmia	285	73.6	68.9-77.9
Lack of satisfaction	317	81.9	77.7-85.6
Dyspareunia	246	63.6	58.6-68.4

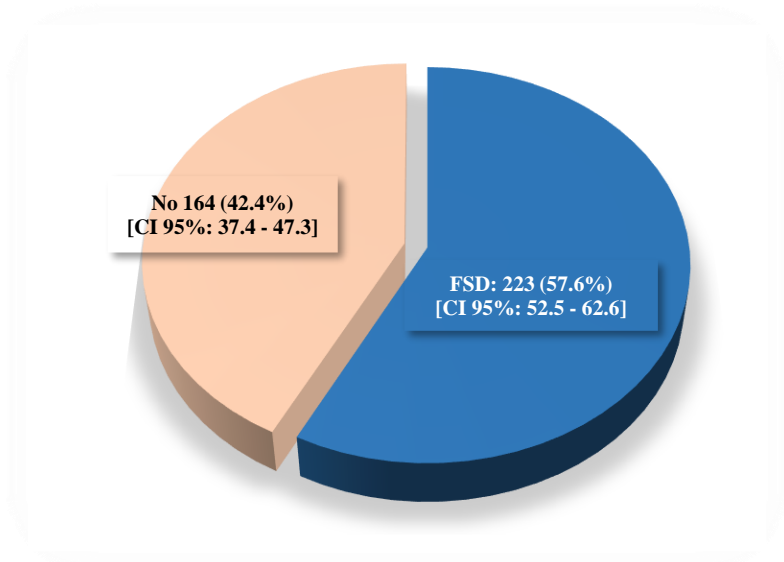


Figure 2 The overall FSD rate of the sample

Table 3 presents the distribution of sexual disorders according to age group. In the same age group, the rates of various sexual disorders were distributed in an ascending direction, with the lowest for dyspareunia, insufficient vaginal lubrication, anorgasmia, lack of satisfaction, reduced arousal, and the highest reduced libido. However, for the age group 18-30 years, the rate of lack of satisfaction appears to be higher than that of reduced arousal, and the other sexual disorders follow a similar direction. Table 4 shows changes in sexuality after SARS-CoV-2 infection. Approximately 47% of women experience a lower frequency of intercourse, and only 43% feel less sexual satisfaction than before SARS-CoV-2 infection.

Table 3 Sexual disorder distribution by age group

Sexual dysfunction (n, %)								
Age group	N	Overall sexual disorder	Reduced libido	Reduced arousal	Reduced lubrication	Anorgasmia	Lack of satisfaction	Dyspareunia
18-30	94	46 (48.9)	80 (85.1)	70 (74.5)	56 (59.6)	65 (69.1)	77 (81.9)	53 (56.4)
31-40	179	99 (55.3)	168 (93.9)	151(84.4)	124(69.3)	129(70.9)	143(79.9)	117(65.4)
41-49	114	78 (68.4)	109 (96.6)	99 (86.8)	88 (77.2)	91 (79.8)	94 (82.5)	76 (66.7)

Table 4 Changes in sexual function between pre- and post-SARS-CoV-2 infection

Description	Number of cases	Rates (%)
Frequency of intercourses		
Same as previously	198	51.2
Less than previously	180	46.5
More than previously	9	2.3
Sexual satisfaction		
Same as previously	213	55.0
Less than previously	166	42.9
More than previously	8	2.1

Table 5 presents multivariate analysis of FSD-related factors. According to univariate analysis, three risk factors for FSD are “age group 41-49”, “2 or more SARS-CoV-2 infections” and “post-infection short period”. Since there are few independent variables,

multivariate regression analysis includes all five variables in cluding age group, obstetric history, number of SARS-CoV-2 infections, hospitalization, and post-infection period to identify FSD-related factors. The results show that two factors are related to overall FSD: “age group 41-49” and “post-infection period”. Women aged 41-49 years have significantly elevated PR*, that is, 1.37 times the PR* of women aged 18-30 years (p<0.05). Women with FSD experience a shorter post-infection period than those without FSD (p<0.05).

Table 5 Sexual dysfunction and related factors

Sex related factors	Positive sexual dysfunction n= 223 (%)	Negative sexual dysfunction n= 164 (%)	PR*	95%CI PR*	p**
Age group					
18-30	46 (48.9)	48 (51.1)	1	-	-
31-40	99 (55.3)	80 (44.7)	1.15	0.89-1.49	0.396
41-49	78 (68.4)	36 (31.6)	1.37	1.06-1.76	0.017
Obstetric history					
No birth	31 (52.5)	28 (47.5)	1	-	-
Normal delivery	97 (61.8)	60 (38.2)	1.07	0.81-1.41	0.613
Cesarean section	95 (55.6)	76 (44.4)	0.95	0.72-1.26	0.733
Number of infections					
1	160 (53.9)	137 (46.1)	1	-	-
≥ 2	63 (70.0)	27 (30.0)	1.17	0.97-1.41	0.095
Hospitalization					
Yes	200 (57.3)	149 (42.7)	1	-	-
No	23 (60.5)	15 (39.5)	0.94	0.72-1.22	0.628
Post-infection period (months)	10.8 ± 6.6	13.2 ± 7.3	-	-	0.005

PR*: Poisson multivariate regression p**: p value of Poisson multivariate regression

4. DISCUSSION

This is the first study to assess sexual function in women infected with SARS-CoV-2 in Vietnam. The data from this study will provide essential information for future studies and health education programs for Vietnamese women following the COVID-19 pandemic. The women in this study had been infected with SARS-CoV-2; of these, 76.7% had contracted the disease once and then recovered, 20.2% had had a second infection, and the rest (3.1%) had been infected three times (Table 1). The re-infection rate in our study was much higher than that found by Zare et al., (2021) in Iran (0.25%; female re-infection rate = 0.198%, male re-infection rate = 0.296%), by Philippe Brouqui in France (0.47%) Brouqui et al., (2021), and Aparna Mukherjee in India (4.5%) (Mukherjee et al., 2021). This may be due to the four consecutive waves of COVID-19 that occurred in HCMC, whereby those infected with an antecedent variant were caught by the following wave.

This study also reported an infection management hospitalization rate of 9.8% (Table 1). The hospitalization rate was lower than that described by Zare et al., (2021) in Iran (45.8%). Differences in hospitalization rates depend on outbreak conditions, healthcare facilities, patient health status, and local infection control regulations. The study revealed that 223 women (57.6 %) experienced FSD (Table 2). This percentage is much higher than those shown by studies conducted before the pandemic: By Ngo Thi Yen in 2013 with 1160 women in HCMC (34.2%), Sidi et al., (2007) in 2007 with 230 Malaysian women (29.6%), and Starc et al., (2018) in 2015 with 605 Slovenian women (31%). Compared to other studies conducted since the Covid-19 outbreak, the overall FSD rate was comparable. Udomsak Narkkul’s study was the first, conducted in Thailand in 2021 (60.8%); it suggested that the high FSD rate might be stress and depression resulting from the loss of family members, financial hardship, unemployment, and an undetermined future during the Covid-19 pandemic (Narkkul et al., 2022).

A study by Gencer et al., (2022) yielded a similar result. It assessed the sexual function of two female groups: 50 women with a history of SARS-CoV-2 infection and 51 women without a history of infection. The results showed that women with a previous SARS-CoV-2 infection had an overall FSD rate of 63.8%, 3.4 times higher than those without Covid-19 infection. FSD may be caused by various factors, including biological and psychological issues and social conditions. Stress and anxiety continued to be experienced in COVID-19 infected women even after recovery, which made the FSD rate in women with previous COVID-19 infection much higher than that in women without previous infection (Gencer et al., 2022). The results also showed that the rate of specific sexual disorders increased considerably, ranging from 63.6 to 92.2%.

The rates were also much higher than those of studies conducted before the pandemic, including those of Tao et al., (2018) in China in 2018 (41.1-85.7%), Witting et al., (2008) in the United States in 2008 (20.9- 55.3%) and Castellini et al., (2010) in the United States in 2010 (17.9-34.4%), and Ngo Thi Yen in Vietnam in 2013 (30-40.5%). Both our study and others assessing female sexual function post-pandemic revealed that the rates of specific sexual disorders increased significantly. Salma Samir Omar's study conducted in Egypt in 2021 produced the following results: Dyspareunia (97.3%), reduced libido (81.6%), reduced lubrication (81.2%), reduced arousal (77.2%), anorgasmia (68.5%), and dissatisfaction of satisfaction (64.7%) (Omar et al., 2021). Anna Fuchs' study conducted in Poland in 2020 also pointed out that the FSFI mean scores of all sexual domains had significantly decreased compared with those before the pandemic.

The author explained that the reduction in FSFI scores in all sexual domains resulted from the psychological impact of isolation during the pandemic, leading to severe negative effects on female sexual function (Fuchs et al., 2020). Our study also found that 46.5% of women had reduced coital frequency after SARS-CoV-2 infection (Table 4). This result is relatively comparable to that of Räuchle et al., (2022) in Germany in 2020 while the COVID-19 pandemic was ongoing, with 34.9% of 611 female participants reporting low intercourse frequency. Women infected with SARS-CoV-2 suffered post-COVID 19 sequelae like prolonged fatigue, chronic cough, headache, palpitations, insomnia, and diminished sex drive, causing a remarkable decrease in coital frequency (Ciotti et al., 2019).

In addition, intercourse frequency in women is lower because of economic downturns, increased unemployment, and social relationship conflicts. This study also found that approximately 43% of women experienced unsatisfactory sexual relations after SARS-CoV-2 infection (Table 4). This is comparable to the survey by Osur et al., (2021) conducted with Kenyan couples in 2020, which reported considerably lower sexual satisfaction after the pandemic outbreak. Specifically, the rate of sexual satisfaction was 73.4% before the pandemic but decreased to 58.4% afterward (Osur et al., 2021). These findings reveal that the COVID-19 pandemic negatively impacted female sexuality. Our study results demonstrate that the COVID-19 pandemic and SARS-CoV-2 infection enormously increased rates of sexual dysfunction in the female population of Phu Nhuan District as compared to the situation ten years ago.

In Ngo Thi Yen's study in 2013, using the same FSFI assessment tool, the overall FSD and specific sexual disorder rates were 34.2% and 30-40.5%, and in our study were 57.6% and 63.6-92.2%. A Poisson multivariate regression model was employed to control confounders, and two factors associated with FSD, age group and post-infection period, were detected. First, women aged 41-49 had an overall FSD rate 1.37 times higher than that of those aged 18-30, an association that is statistically significant ($p = 0.05$, 95% CI: 1.06-1.76) (Table 5). Ngo Thi Yen's study also recorded those women aged 31-40 had an elevated FSD risk two times higher than that of women aged less than 25 years. This finding is comparable with those in a study conducted by Hayes et al., (2008) with 356 Australian women aged 20-70 years, which found that sexual disorders such as low rates of libido, reduced arousal, failure to orgasm, and painful sex were associated with the 41-49 age group.

Women experience massive psychological and physiological changes during the perimenopausal and menopausal stages of their lives that greatly influence female sexual function. Our study conducted with women post-SARS-CoV-2 infection surmised that those who are older may have a poorer ability to recover, leading to an overall higher FSD rate for them in comparison to younger women. The second FSD-related factor was the duration of the post-infection period. Women with FSD experienced a shorter interval between last infection and date of the survey than those without FSD (Table 5). This is possibly due to anxiety while suffering from the disease, which negatively affects female sexual function. Another explanation is that post-COVID-19 infection, women require a lengthy recovery period, leading to higher overall FSD rates.

A strength of our study is that we used the FSFI questionnaire translated into Vietnamese and locally customized and assessed its value and reliability in Vietnam. This is an effective tool for proper assessment of female sexual function. Additionally, we achieved a high feedback rate (97%). In addition to the Google form offering advantages in collecting sensitive information, local health staff

provided support in gaining access to the selected women. This study also used PPS sampling to obtain a good representation of the relevant population. In the last decade, HCM City Department of Health have recognized the critical role of female sexual dysfunction screening and treatment. That was why the unit of sexual dysfunction management was established at Tu Du Hospital in 2015. The largest Ob/Gyn hospital in Vietnam admit patients from all southern provinces. It has good specialists in this domain. When a patient with sexual dysfunction was detected, we referred her to this hospital for treatment.

This study has some limitations. First, cross-sectional study design is not advantageous for identifying cause-and-effect associations and there may be some recall bias. Although the sample was representative of the Phu Nhuan population, the extrapolated values have not yet been demonstrated. Second, the FSD-related factors described in this study are not as relevant as those in other studies since we focused solely on independent variables associated with SARS-CoV-2. Third, one of various sexual dysfunction determinants is related to psychological or social factors. However, here is a cross-sectional study using a Google form tool to collect information which were not assessed with in-depth interviews by psychologists. Finally, our study referred patients with FSFI to the treatment unit without follow-up or supervision.

5. CONCLUSION

This study provides evidence of FSD status in women infected with SARS-CoV-2 in Phu Nhuan District. Overall, FSD and specific sexual disorder rates increased significantly after the Covid-19 pandemic. This has a critical effect on the sexual health of women. We recommend that post-SARS-CoV-2 infected women be screened for any abnormalities in their sexual life so that they can receive timely treatment. Our study paves the way for future studies on recovery duration to inform treatment for women with FSD after SARS-CoV-2 infection.

Abbreviations

FSD: Female Sexual Dysfunction; FSFI: Female Sexual Function Index; PR: Prevalence Ratio; CI: Confident Interval.

Ethics approval and informed consent

This study was conducted in accordance with the Declaration of Helsinki. Ethics approval for the study was obtained from the University of Medicine and Pharmacy at Ho Chi Minh City (Approval number: 709/HĐĐĐ-ĐHYD on 10/10/2022). Written informed consent was obtained from all participants. Data was kept anonymous and confidential during all stages of the study.

Authors' Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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